

**Response Under 37 CFR 1.116**

**Expedited Procedure**

**Examining Group 1793**

Application No. 10/516,431

Paper Dated: June 30, 2008

In Reply to USPTO Correspondence of December 28, 2007

Attorney Docket No. 4623-045789

**REMARKS**

The Office Action of December 28, 2007 has been reviewed and the comments therein carefully considered. The application has been amended. Specifically, claim 28 has been added. Claim 28 represents a combination of claims 1, 4 and 6 in independent form. Support for this amendment can be found throughout the specification and claims as originally filed, such as in claims 1, 4 and 6. No new matter is added by this amendment. Accordingly, claims 1-4, 6, 9-17, 19-20, 22-23 and 25-28 are currently pending in this application.

In the Final Office Action of December 28, 2007, claims 1-3, 6, 9-12, 16, 20, 22, 23 and 25-27 were rejected under 35 U.S.C. § 103(a) as being unpatentable over WO 92/018249 to Beeby. Claims 4 and 13-15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Beeby in view of the article *Microwave Energy for Mineral Treatment Process – A Brief Review* by Kazi Haque (“Haque”). Claim 17 was rejected under 35 U.S.C. § 103(a) for obviousness over Beeby in further view of GB 2,198,242 to De Beers Industrial Diamond Division (“De Beers”). Finally, claim 19 was rejected under 35 U.S.C. § 103(a) for obviousness over Beeby and further in view of U.S. 3,261,959 to Connell or Haque. Applicants respectfully traverse each of these rejections.

Beeby is directed to a method of recovering valuable materials from crushed ore by exposing the ore to pulses of microwave energy of duration between 1 and 30 seconds. Beeby does not teach or disclose exposing ore to pulses of microwave energy having a duration of less than 1 second, as recited in the claims. The Office Action contends that one skilled in the art would find it obvious in view of Beeby to modify the pulse duration taught therein to arrive at Applicants' invention where the ores are exposed to a pulse of less than 1 second because “where the claimed ranges overlap or lie inside ranges disclosed in the prior art, a *prima facie* case of obviousness exists.” (December 28, 2007 - Office Action, page 3).

While this may be a correct statement of the law, the present case does not involve a claimed range that falls within or overlaps with a range disclosed in the art. Instead, Applicants' pulse duration of less than 1 second lies entirely outside of the pulse duration range of 1 to 30 seconds disclosed by Beeby. Nowhere does Beeby disclose, teach

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or even suggest exposing an ore to a pulse of microwave energy where the pulse has a duration of less than 1 second. Further evidence for this position can be found in the Declaration under 37 C.F.R. § 1.132 of Dr. Raymond Walter Shaw (“Shaw Declaration”).<sup>1</sup> Dr. Shaw, one of the named inventors on the subject application and an expert in the field, states that “[t]here is no overlap between these ranges of pulse durations. The ranges are quite distinct...” (Shaw Declaration, ¶ 8) (emphasis in original). Thus, a *prima facie* case of obviousness is not necessarily established by an overlap of the pulse duration range recited in the claim and that disclosed in the cited art because no such overlap exists.

Furthermore, the difference between the pulse duration range recited by Applicants and that recited in Beeby is significant. As stated by Dr. Shaw: “A key feature of the method [of the subject application] is the use of short duration pulses of microwave energy.” (Shaw Declaration, ¶ 6). Differential thermal expansion and the resulting high stress/strain regions which lead to microcracking occur due to the response of ore particles to pulsed microwave energy. (Shaw Declaration, ¶ 9). Short duration pulses are essential in achieving a very rapid differential heating between a first component, such as a susceptor mineral, and other minerals in the ore particles. (*Id.*). These short duration pulses allow very high energy microwaves to be provided to the susceptor minerals, which maximizes their expansion as compared to the expansion exhibited by other minerals in the ore. (*Id.*). According to Dr. Shaw, this phenomenon cannot be achieved using pulses of longer duration, such as those disclosed by Beeby, because the minerals become overheated and may even melt during such prolonged exposure to microwave energy. (*Id.*). In fact, with respect to some minerals, longer low energy pulses may not even cause microcracks at all because the heat transfer between the different phases which causes microcracking may be alleviated prior to the cracks forming. (*Id.*). According to Dr. Shaw, the ability to generate such high stresses with very short pulse durations was an unexpected finding not disclosed by Beeby. (*Id.*). Additionally, Dr. Shaw notes that use of a short pulse time enables the application of microwaves in a “flow-through” type application system where the ore is exposed while traveling along a chute or conveyor belt, which would not be possible if a longer exposure

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<sup>1</sup> While the Shaw Declaration lists a signature date of July 26, 2008, it was received by the undersigned on June 26, 2008. The date listed on the signed document is an obvious typographical error.

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time were necessary, such as in Beeby where the ores are kept in a microwave furnace for an extended time. (Shaw Declaration, ¶ 12). Thus, Applicants submit that a method of treating ores by subjecting them to a pulse of microwave energy of less than 1 second in duration is not obvious in view of Beeby.

Claim 4 further defines the method of claim 1 by adding the step of screening the ore particles prior to exposing them to microwave energy in order to remove fines from the ore particles. The process of Beeby, on the other hand, operates with fines as opposed to without fines, as evidenced by the particle size distribution in Table 2 on pages 5 and 6. (Shaw Declaration, ¶ 10). In fact, Beeby passes the ore particles through a 2 mm screen in order to ensure that fines are included, as opposed to excluded as in claim 4. Said differently, Beeby screens fines in while Applicants screen fines out, and in this sense Beeby teaches away from the invention recited in claim 4. Applicants have discovered that the subject invention works more effectively on larger particle sizes than on fines since fines are less likely to undergo microcracking when exposed to short pulses of microwave energy. (Shaw Declaration, ¶ 11).

In the Office Action, it is contended that Haque teaches the importance of particle size when heating ores and thus particle size is a result effective variable that would have been optimized as a matter of routine investigation. However, as read by one skilled in the art, Beeby is already “optimized” with respect to particle size. (Shaw Declaration, ¶ 10). Furthermore, Haque is not directed to a process involving a pulsed microwave field. In fact, the example data disclosed by Haque in Tables 7-9 is based on the constant exposure of the ore sample to the microwave energy source for, generally speaking, at least 1 minute.<sup>2</sup> (Haque, pg. 10-12). Thus, Haque’s teachings with respect to heating and particle size are considerably less relevant to Applicants’ method where energy exposure is limited to pulses of less than one second than is Beeby which teaches pulsed energy. As discussed above, Beeby teaches away from the exclusion of fines by screening the ores to ensure such fines are present during treatment.

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<sup>2</sup> While some of the examples performed by Haque did include an energy exposure time of less than 1 minute, the length of the exposure was shortened due to the arcing or melting of the sample or because the maximum temperature was reached.

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Additionally, while Haque indicates that particle size is an important factor in heating granular materials, it also states that it is not a consistent factor, with fine  $\text{Al}_2\text{O}_3$  heating faster than course  $\text{Al}_2\text{O}_3$  and coarse  $\text{Fe}_3\text{O}_4$  heating faster than fine  $\text{Fe}_3\text{O}_4$ . (Haque, pages 11-12). With the unpredictable role of particle size disclosed in Haque, it is hard to envision it being a result oriented variable (i.e. “a variable which achieves a recognized result”) that one skilled in the art would choose to optimize. (M.P.E.P. § 2144.05, II, B). Consequently, modifying the teachings of Beeby to include a step of screening the ore particles to remove fines would not be obvious to one skilled in the art. (Shaw Declaration, ¶ 10).

With respect to claim 6, Applicants recite that the microwave energy to which the ores are subjected is high energy, which is defined in the specification as energy substantially above that of conventional household microwaves, i.e. substantially above 1kW. (Specification, page 5). To the contrary, the energy levels disclosed by Beeby are much lower, such as 650 W or 1300 W. The Office Action contends that Beeby, by disclosing an energy level of 1300 W, meets the limitation in claim 6 related to “high energy” exposure. (December 28, 2007 - Office Action, page 3). However, interpreting the 1300 W energy level disclosed in Beeby as “high energy” is improper and inconsistent with the reading that would be afforded Beeby by one skilled in the art. For instance, Dr. Shaw, in his Declaration, states that: “Beeby operates at considerably lower energies. The examples refer only to 650 W and 1300 W. These are not high energies.” (Shaw Declaration, ¶ 14). Additionally, modifying Beeby to include energy pulses of high energy would be impractical. As explained above, Beeby’s method specifically includes the treatment of fines. Exposing these fines to high energy pulses of over 1 second in duration would overheat the fines and change the mineralogy of the particles in an undesirable manner. (*Id.*). Further, Beeby actually teaches away from using pulses at higher energy levels. On pages 8 and 9, Beeby states that using the “highest microwave energy processing” caused a plasma to form resulting in particles fusing together and lessening the amount of gold extraction. According to Dr. Shaw, Beeby’s low energy, long pulse duration method is completely different from that recited in claim 6, and there is no basis to modify the method of Beeby in any way to arrive at the claimed method. (*Id.*).

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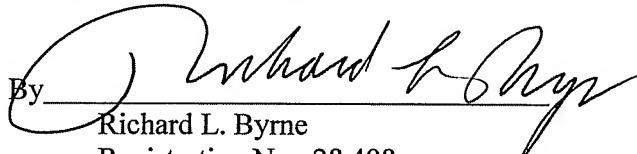
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Newly added claim 28 is a combination of the limitations in claims 1, 4 and 6, written in independent form. For at least the reasons discussed above, Applicants submit that this claim is also patentable over the cited documents of record.

For all of the foregoing reasons, Applicants submit that pending claims 1-4, 6, 9-17, 19-20, 22-23, and 25-28 are patentable over the cited documents and are in condition for allowance. Accordingly, reconsideration of the rejections and allowance of pending claims 1-4, 6, 9-17, 19-20, 22-23 and 25-28 are respectfully requested.

Respectfully submitted,

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